Humboldt-Universität zu Berlin

Geography Department

Geomatics[1] and Biogeography[2] Labs

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Synergies between future Landsat and European satellite missions for better understanding coupled human-environment systems

- Our team is supported…

  …at **HU Berlin** by Patrick Griffiths, Pedro Leitão, Sebastian van der Linden

  …in **Germany** by Hermann „Charly" Kaufmann (GFZ Potsdam), Achim Röder and Thomas Udelhoven (U Trier), Björn Waske (U Bonn)

  …**beyond Germany** by Warren Cohen (USDA-FS / Oregon State), Robert Kennedy (Boston), Volker Radeloff (Madison), Ruth Sonnenschein (EURAC, Bolzano, Italy)

Land System Science Cluster @ HU Berlin, Germany

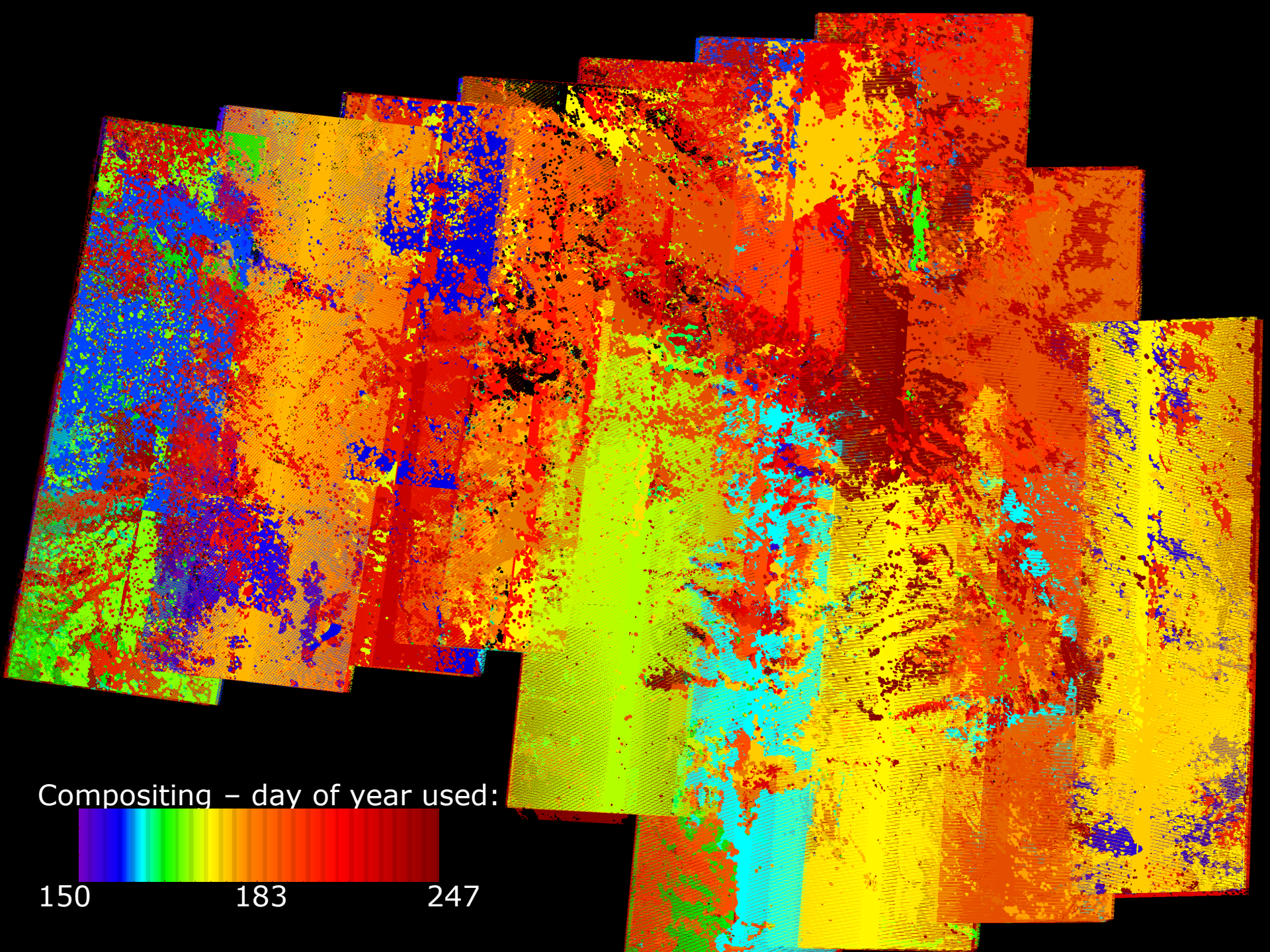
- Research foci:
  - interaction of global (climate) change and land use change
  - influence of land use on carbon cycling and natural habitats

- Methods foci
  - large area mapping and monitoring
  - high temporal resolution image analysis (gradual changes, phenology)
  - imaging spectroscopy (EnMAP Toolbox)

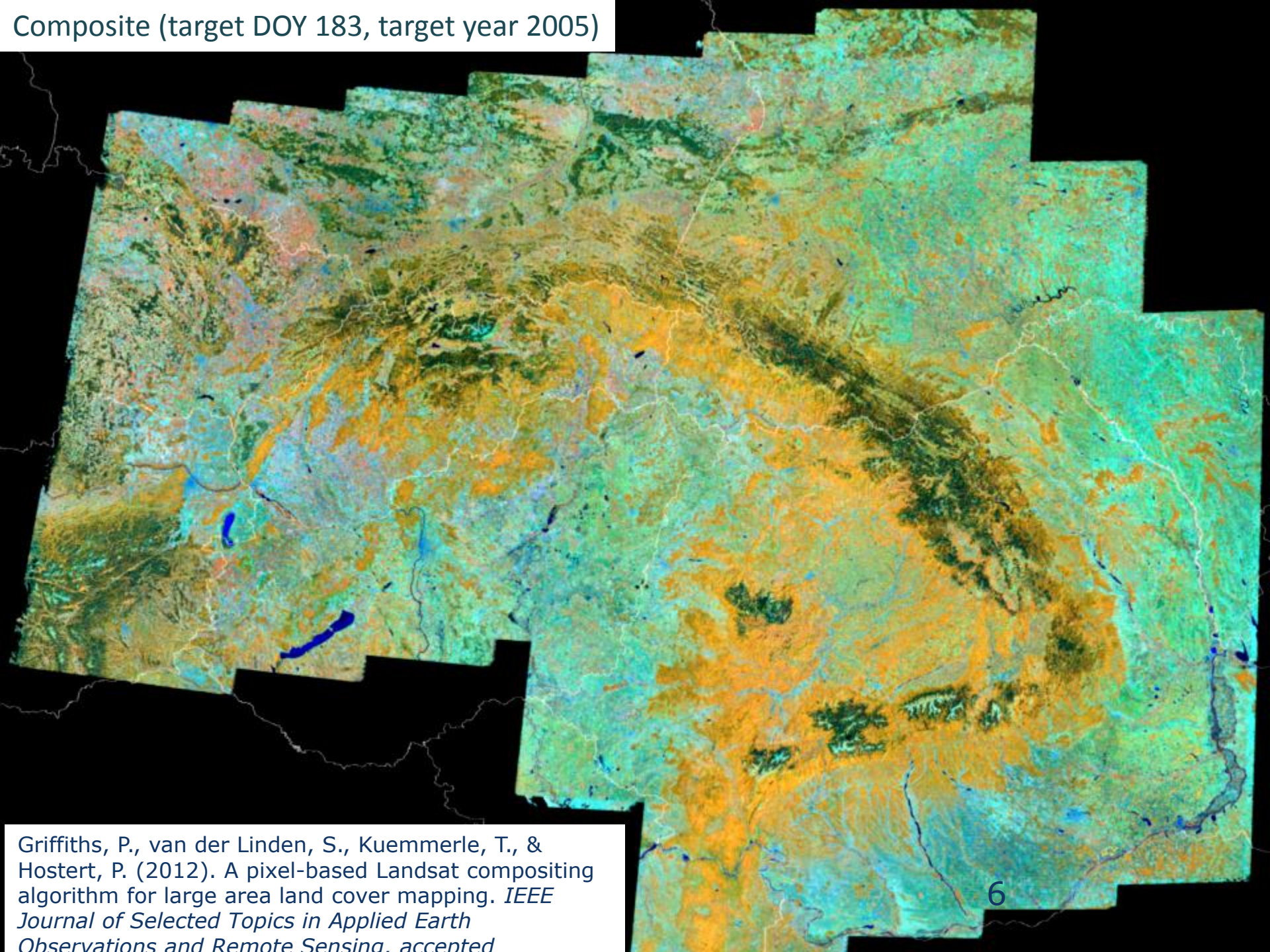
- Regional foci
  - Europe (pan-European land change and LUI indicators)
  - SE-Asia (REDD+ in Laos, Vietnam, Indonesia and S-China)
  - S-America (Brazil – Amazon and Cerrado, Argentina - Chaco)

Research interests and objectives in the LST

- Creating MODIS-like products from LDCM and historic Landsat data

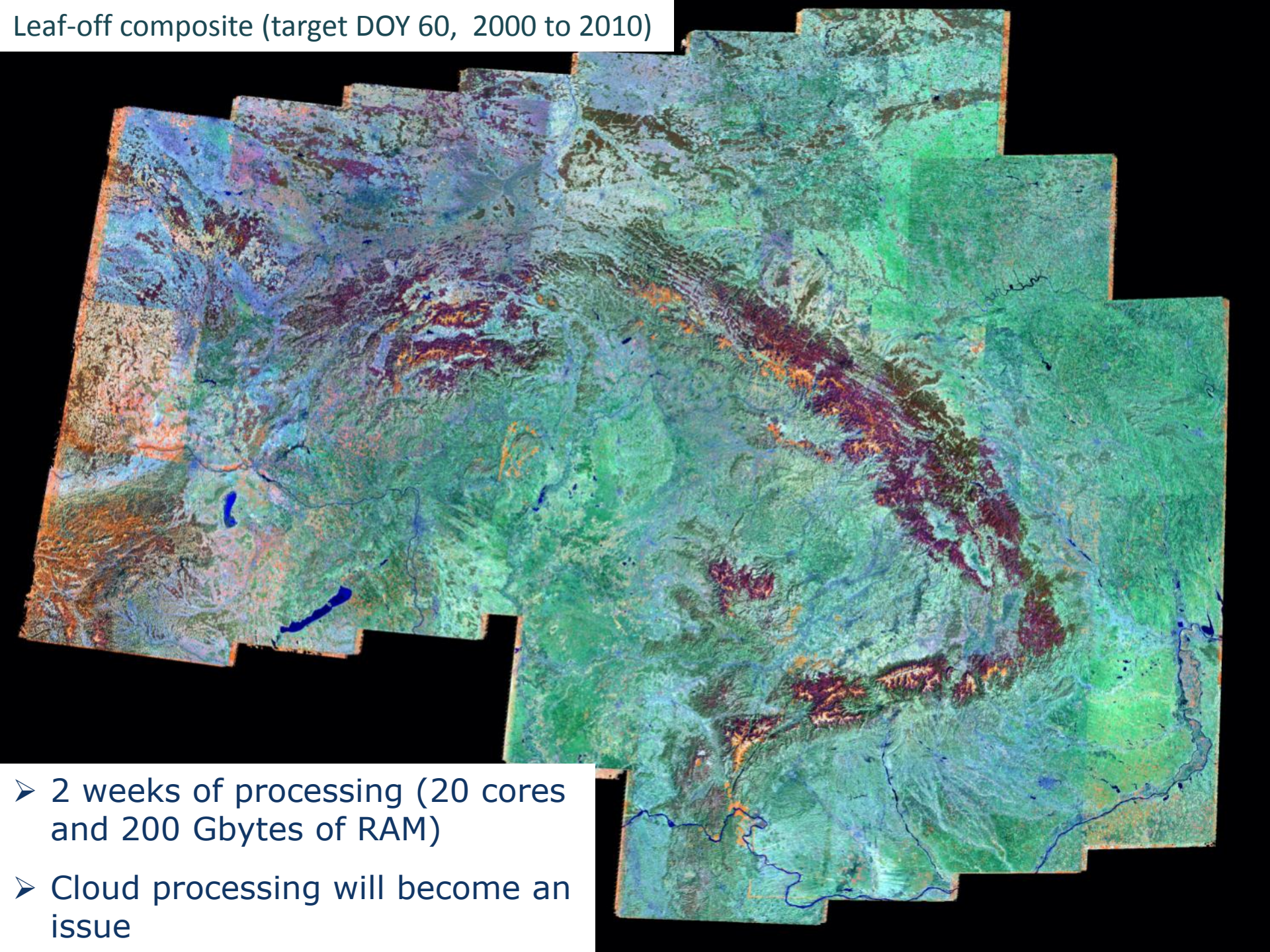

Compositing – day of year used:
150
183
247

Composite (target DOY 183, target year 2005)



Griffiths, P., van der Linden, S., Kuemmerle, T., & Hostert, P. (2012). A pixel-based Landsat compositing algorithm for large area land cover mapping. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, accepted*

Leaf-off composite (target DOY 60, 2000 to 2010)



- 2 weeks of processing (20 cores and 200 Gbytes of RAM)
- Cloud processing will become an issue

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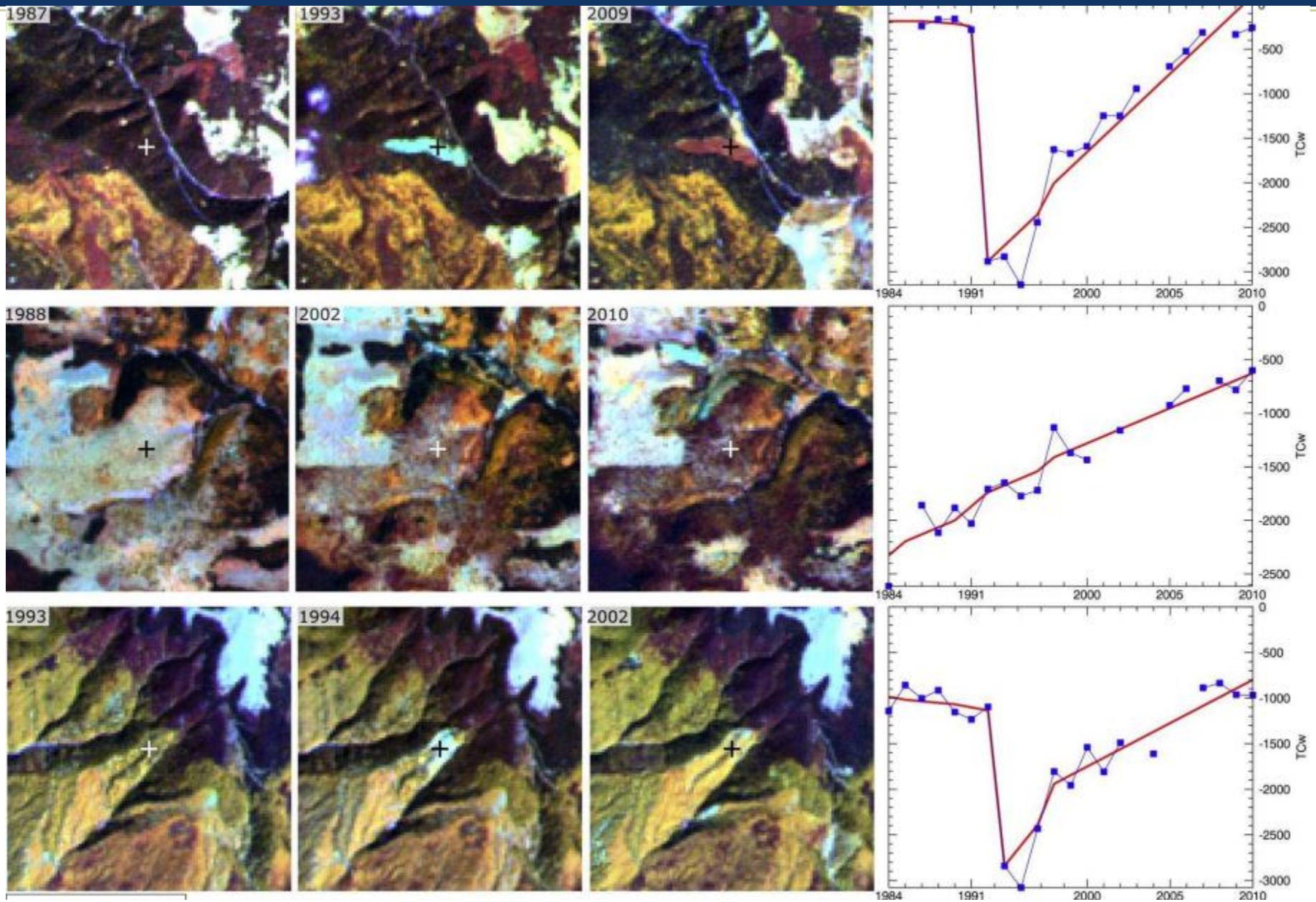
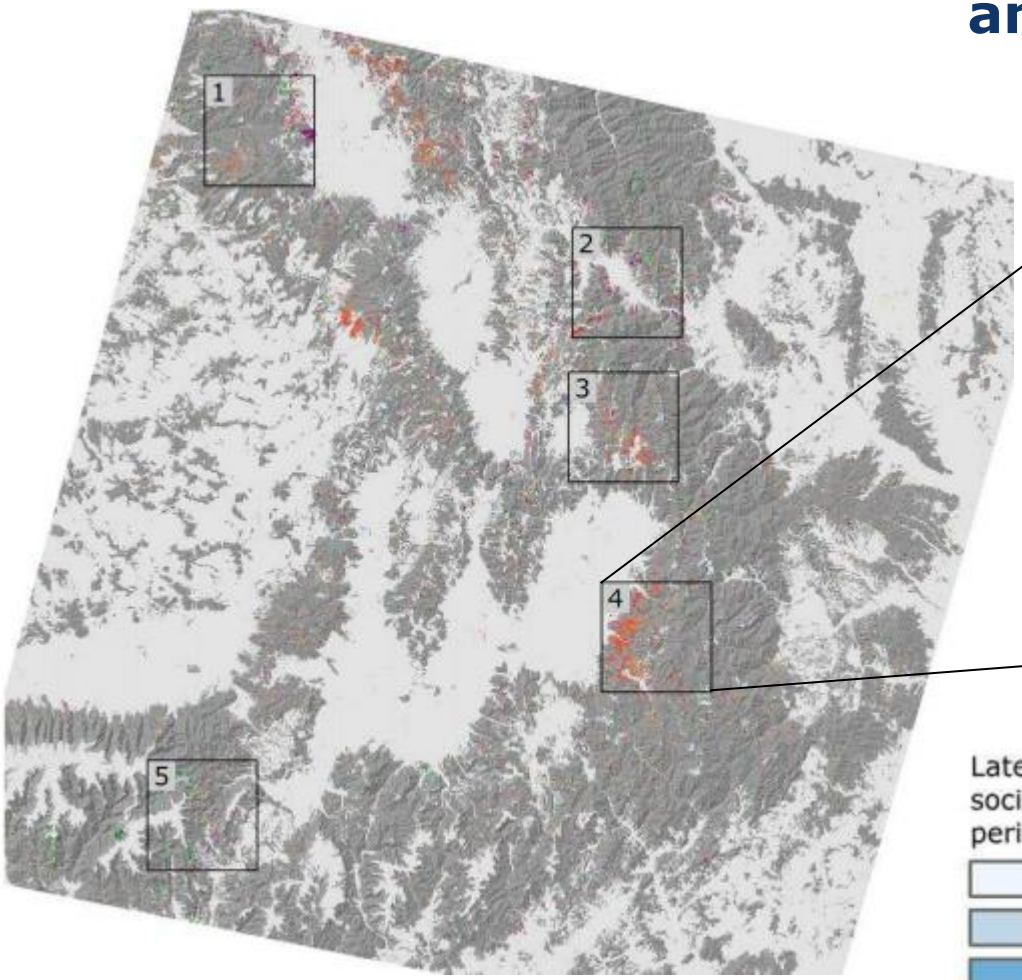
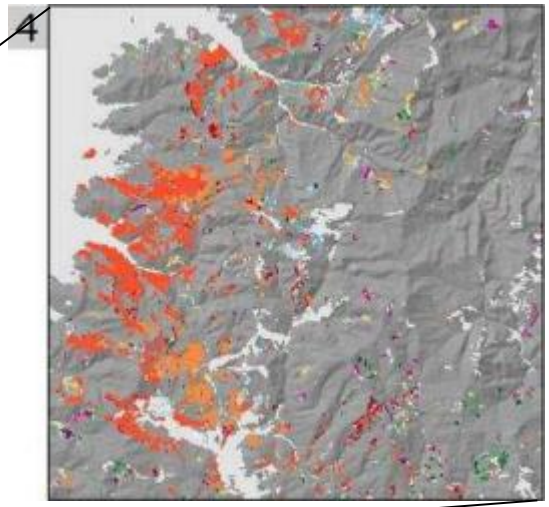
- Exploit the full temporal depth of the archive to analyze more subtle spatio-temporal gradients (e.g. focusing on LUI instead of LULCC)



Griffiths, P., Kuemmerle, T., Kennedy, R.E., Abrudan, I.V., Knorn, J., & Hostert, P. (2012). Using annual time-series of Landsat images to assess the effects of forest restitution in post-socialist Romania. *Remote Sensing of Environment, 118, 199-214*

Forest restitution in Romania and logging regimes





Late socialist period: 1986, 1987, 1988, 1989

First restitution period: 1991, 1993, 1994, 1995, 1996, 1998, 1999

Second restitution period: 2000, 2001, 2002, 2003, 2004

Third restitution period: 2005, 2006, 2007, 2008, 2009, 2010

Non forest

Forest

Griffiths, P., Kuemmerle, T., Kennedy, R.E., Abrudan, I.V., Knorn, J., & Hostert, P. (2012). Using annual time-series of Landsat images to assess the effects of forest restitution in post-socialist Romania. *Remote Sensing of Environment, 118, 199-214*

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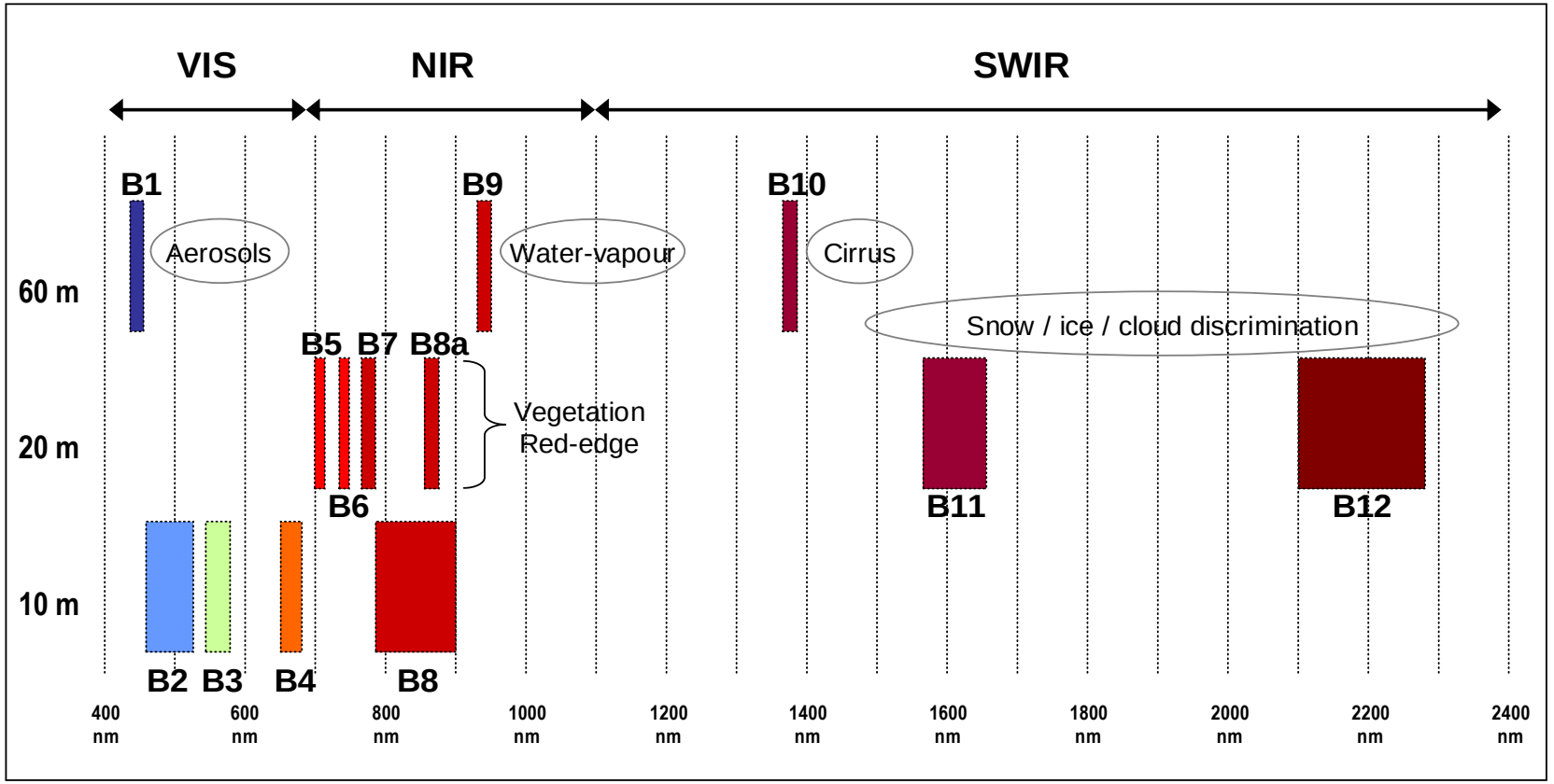
- Exploit the full temporal depth of the archive to analyze more subtle spatio-temporal gradients (e.g. focusing on LUI instead of LULCC)…
- …also in regions where data is relatively scarce
- Fill gaps either by better multi-scale data integration or optimized integration across different archives

Sentinel-2


VIS
NIR
SWIR
B1
Aerosols
B9
Water-vapour
B10
Cirrus
Snow / ice / cloud discrimination
60 m
B5 B7 B8a
Vegetation
Red-edge
20 m
B6
B11
B12
10 m
B2 B3 B4
B8
400 nm
600 nm
800 nm
1000 nm
1200 nm
1400 nm
1600 nm
1800 nm
2000 nm
2200 nm
2400 nm

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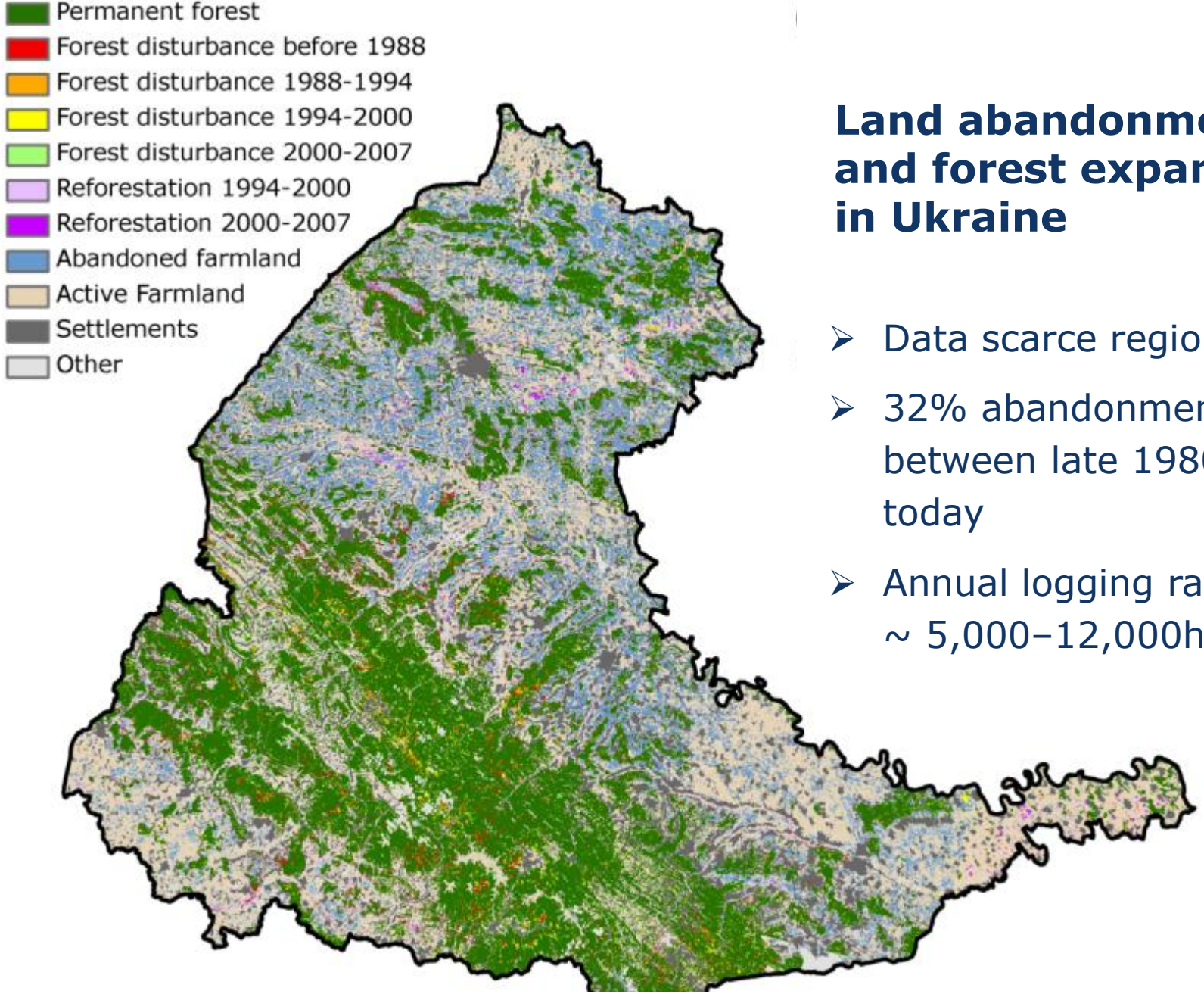
- Better link analyses from Landsat data to their underlying ecological meaning (e.g. concerning carbon fluxes)…

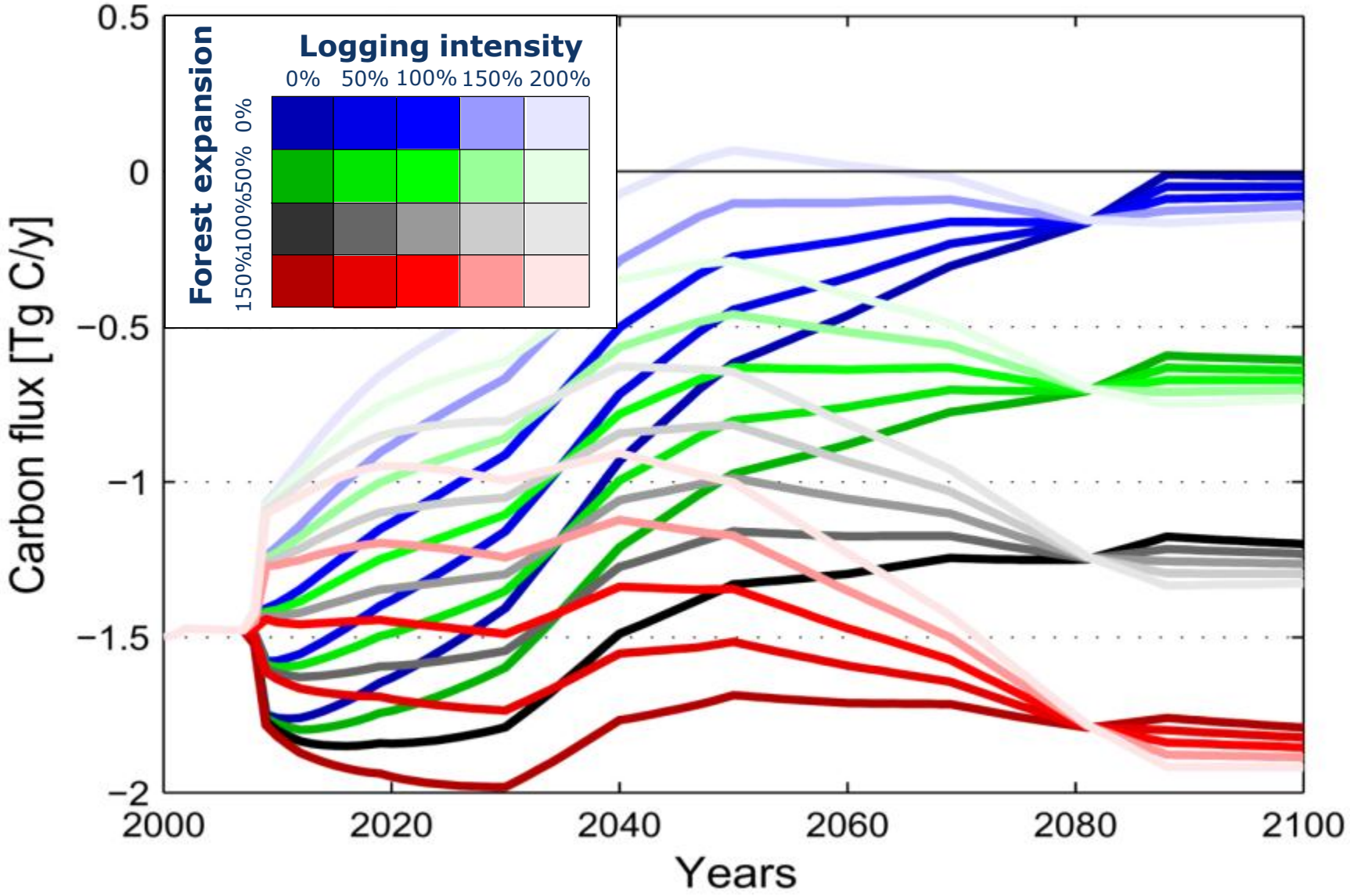


Land abandonment and forest expansion in Ukraine

- Data scarce region
- 32% abandonment rate between late 1980s and today
- Annual logging rates ~ 5,000–12,000ha

Kuemmerle, T., Olofsson, P., Chaskovskyy, O., Baumann, M., Ostapowicz, K., Woodcock, C.E., Houghton, R.A., Hostert, P., Keeton, W.S., & Radeloff, V.C. (2011). Post-Soviet farmland abandonment, forest recovery, and carbon sequestration in western Ukraine. *Global Change Biology, 17, 1335-1349*

Future scenarios for carbon fluxes in Western Ukraine



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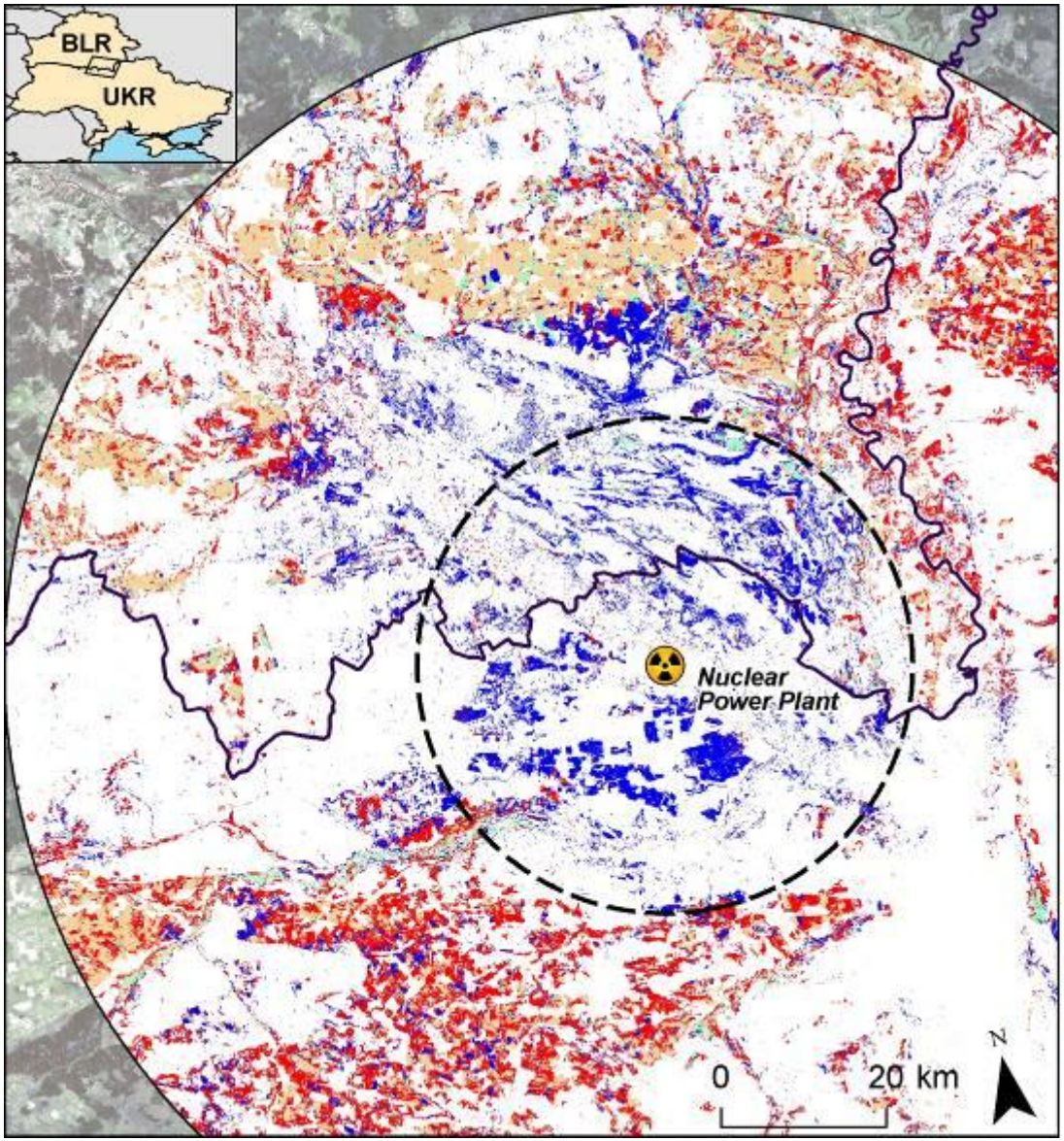
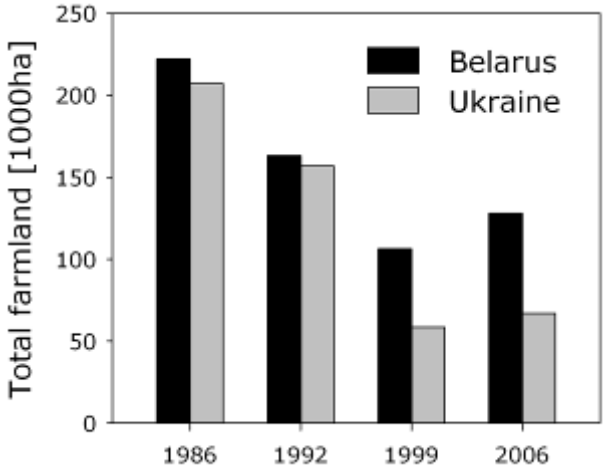
- Better link analyses from Landsat data to their underlying ecological meaning (e.g. concerning carbon fluxes)…
- …and ultimately to integrated processes related to coupled human-environment systems

LULCC after Chernobyl and after the breakdown of the Soviet Union

(http://www.atomicarchive.com 2008)

LULCC after Chernobyl and after the breakdown of the Soviet Union



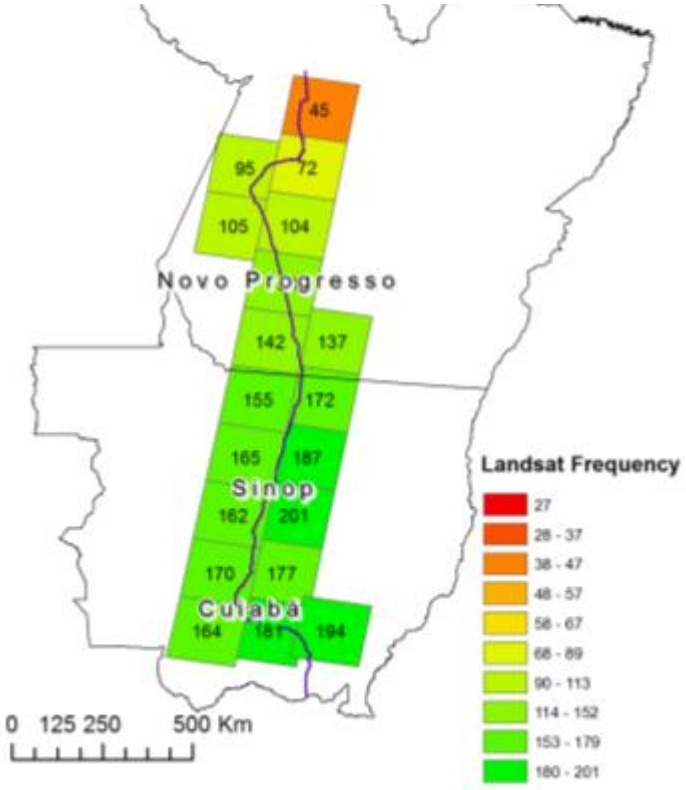


Hostert, P., Kuemmerle, T., Prishchepov, A., Sieber, A., Lambin, E.F., & Radeloff, V.C. (2011). Rapid land use change after socio-economic disturbances: the collapse of the Soviet Union versus Chernobyl. *Environmental Research Letters, 6, 045201*

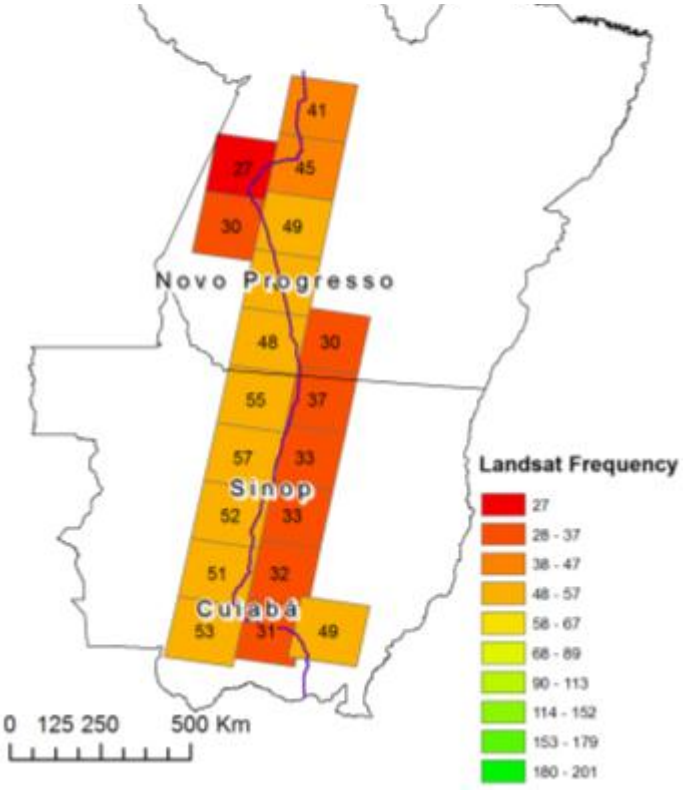
Outlook

- Integrate between Landsat and future Sentinel archives…
- …and better exploit the historical archives

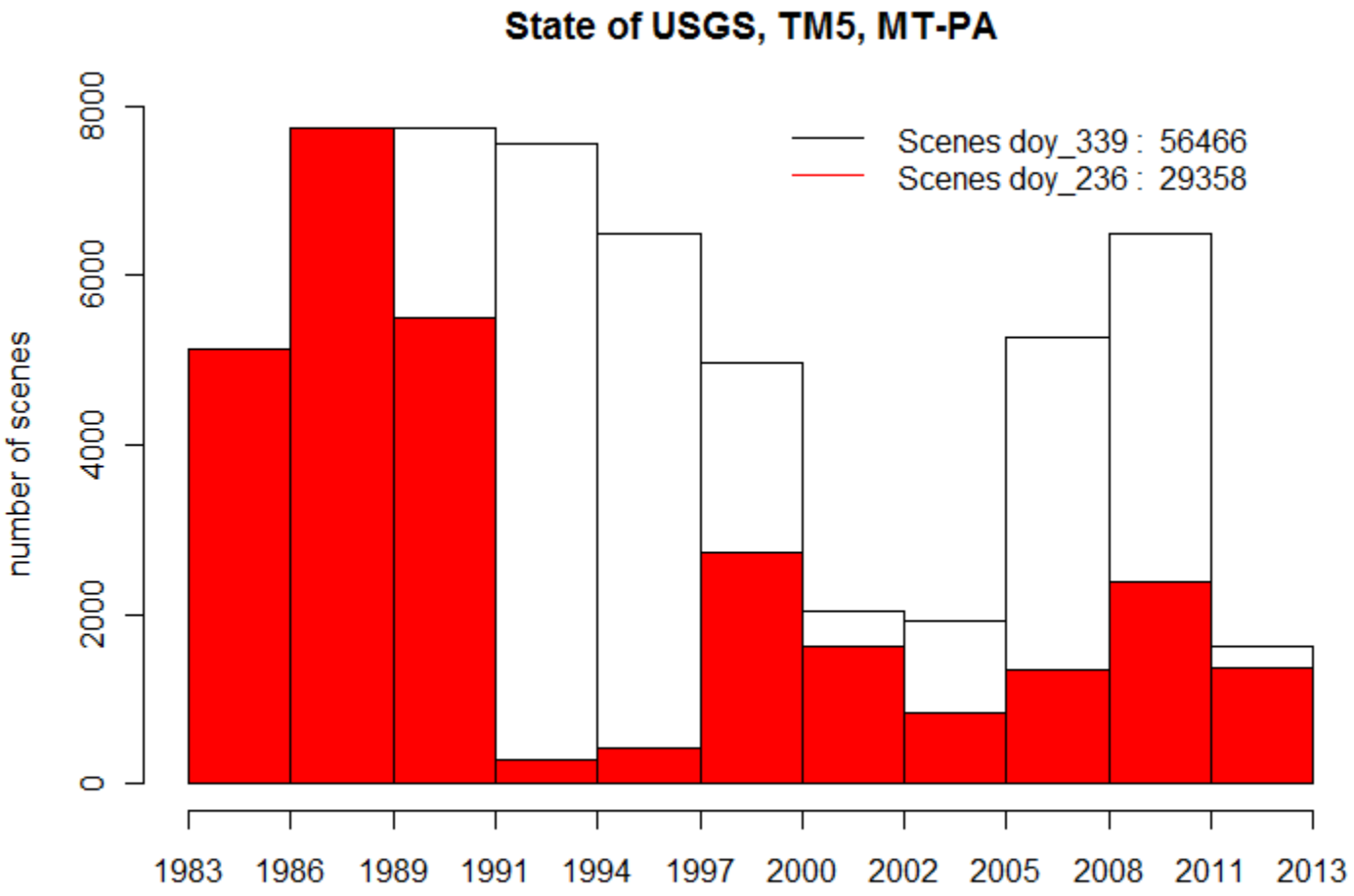
INPE: L2, clouds <50%,TM 5



USGS: L1T clouds <80%, TM 4, 5



Ongoing transfer of scenes from INPE to USGS…



- It might become appealing to bring the algorithms to the data…